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(54) Propeller driven winged aircraft with fixed downwardly inclined thrust line.

(57) An aircraft of swept wing planform with forward cockpit (1) and pylon (8) mounted propeller (9) of larger than customary diameter with fixed downwardly inclined thrust line. The angle of the thrust line in relation to the incidence of the wing is such that when the wing is approaching its stalling angle in level flight the thrust line is at 45% to the horizontal, and the vertical component of the thrust is contributing to lift while the horizontal component of thrust is providing forward propulsion facilitating a shorter take off and landing run and slower flight speed than attainable with aircraft of like power to weight ratio of traditional configuration. The propeller (9) is driven by an engine (4) via a gearbox (5) and shaft (10). The wing root leading edge may include a locker (15) for luggage, or a compartment for an injured person on a stretcher.

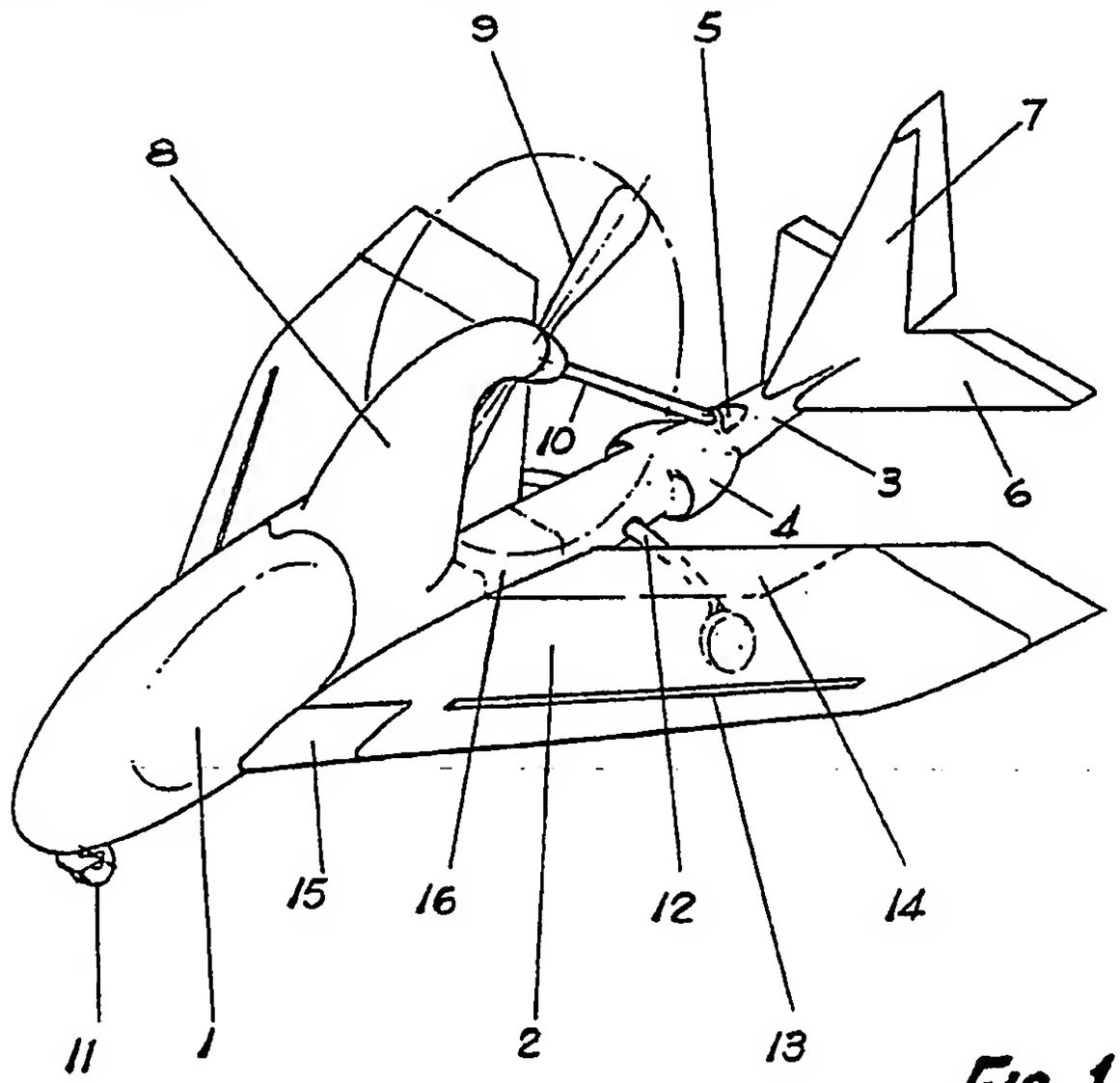

FIG 1

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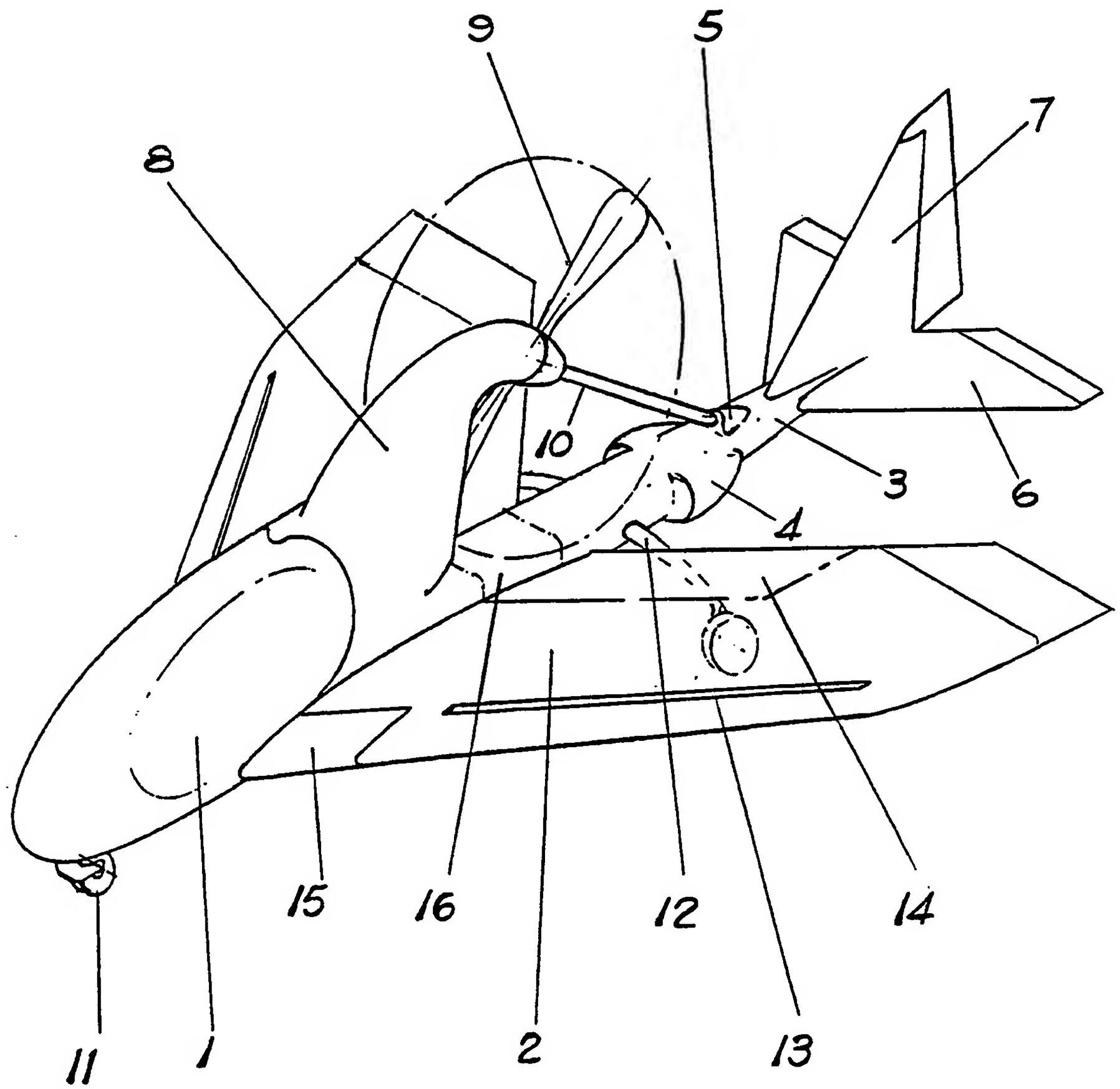

FIG 1

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WINGED PROPELLER DRIVEN AIRCRAFT WITH INCLINED THRUST LINE

This invention relates to a winged aircraft driven by a propeller of larger than customary diameter with fixed thrust line so arranged that when the wings of the aeroplane in level flight approach their stalling angle the propeller thrust line is inclined to the horizontal at approximately 45°.

Winged propeller driven aircraft with fixed thrust line obtain most of the lift required for flight from their wings because the thrust line of the propeller is arranged to correspond generally to the direction of flight and the horizontal datum of the aircraft. In these circumstances the angle at which a propeller with fixed thrust line may be inclined with respect to the horizontal in level flight is limited to about 12° by the stalling angle of the wing. This limits the vertical component of the total propeller thrust that contributes to lift in opposition to the force of gravity to a maximum of about 20% of total available thrust.

According to the present invention the fixed thrust line of the propeller is inclined with respect to the horizontal datum of the aeroplane at an angle which positions the thrust line at an angle of about 45° to the horizontal when the aircraft approaches its stalling speed in level flight at which point the wings are close to their maximum unstalled angle of attack. In these circumstances the vertical component of total available propeller thrust that contributes to lift in opposition to the force of gravity amounts to about 70% of total available thrust. In proportion to the vertical component of thrust available the amount of lift the wing is required to produce to sustain level flight under these conditions is correspondingly reduced.

Lift produced by a wing is proportional to forward speed. If a substantial proportion of the lift required for level flight of an aircraft derives from propeller thrust, the forward speed needed to produce the required amount of wing lift is reduced and level flight may be sustained at a speed lower than would be possible for an aircraft with the propeller thrust arranged generally along the aircraft horizontal datum.

A winged propeller driven aircraft embodying this invention is therefore able to take off and land in a shorter distance and fly more slowly than a winged aircraft with fixed thrust line of similar wing area and installed power which does not embody the invention.

A specific embodiment of the invention will now be described by way of example with reference to the accompanying drawing.

Figure I shows in perspective an aircraft with an enclosed forward mounted cockpit (1) fitted with sharply sweptback wings (2) with a single boom fuselage (3) which accommodates an engine (4) which may be of reciprocating or gas turbine type and a gear box (5) and supporting horizontal tail surfaces (6) and vertical tail surfaces (7). Mounted behind the cockpit is a pylon (8)

which supports a propeller (9) of larger than customary diameter which may be contra rotating and which is located in the vicinity of the vertical datum of the loaded aircraft centre of gravity and is arranged at an angle of 30° with respect to wing chord datum.

The propeller is driven by the engine through a gear box by a driveshaft (10) which is arranged to rotate around a fixed member (not shown) supporting the pylon in relation to the fuselage which restrains the shaft from catastrophic excursions should the shaft suffer a failure.

A nosewheel (11) is mounted towards the front of the craft and a main undercarriage (12) is attached to the fuselage behind the loaded and unloaded centre of gravity datum of the aircraft. The wings are fitted with leading edge slots (13) which may be fixed or moveable and slotted or unslotted flaps (14) at the wing trailing edge which may also be fixed or moveable.

The inboard leading edge portion of the wing adjacent to the fuselage is fitted with doors (15) giving access to lockers for carriage of parcels or persons strapped on to stretchers or litters. The fuselage area to the rearward base of the pylon (16) is protected with armour to obviate damage in the event of a propeller failure or shedding of ice accumulating on the propeller.

CLAIMS

1. A winged aircraft propelled by a propeller of larger than customary diameter located above the fuselage close to the vertical plane of the aircraft's loaded centre of gravity with fixed thrust line inclined downwards and rearwards at such an angle that when the wings approach their stalling angle in level flight the thrust line is inclined to the horizontal at approximately 45°.

2. An aircraft as claimed in Claim 1 wherein the wings are of sharply swept planform such that the slipstream of the propeller mounted close to the vertical plane of the loaded aircraft's centre of gravity is not obstructed in its downwardly inclined passage by the surface of the wing and yet the wing's centre of lift is correctly located with respect to the loaded centre of gravity of the aircraft.

3. An aircraft as claimed in Claims 1 and 2 wherein the propeller hub is mounted upon a pylon sufficiently far above the fuselage as to permit fitment of a propeller of a diameter considerably larger than is customary on a light aircraft while avoiding problems of propeller tip ground clearance.

4. An aircraft as claimed in Claims 1,2, and 3 wherein the plane of the propeller hub along the longitudinal axis of the aircraft is so arranged with respect to the loaded aircraft centre of gravity position that the vertical lift component of the thrust generates a nose up pitching moment that reduces or eliminates the nose down pitching moment resulting from the horizontal component of thrust.

5. An aircraft as claimed in Claims 1,2,3 and 4 wherein the propeller is driven by an engine by means of a transmission which permits the engine to be located in a position ensuring that the loaded centre of gravity of the aircraft remains in the correct relationship to the centre of lift of the wing in combination with the vertical component of the thrust of the inclined propeller.

6. An aircraft as claimed in Claims 1,2,3,4 and 5 wherein the wing is fitted with leading edge slats or slots and/or trailing edge slotted flaps all of which may be fixed or moveable.

7. An aircraft as claimed in Claims 1,2,3,4,5 and 6 wherein the propeller is driven by a hollow shaft which is contained in position in the event of failure of a shaft coupling or of the shaft itself by a stationary structural member which passes internally within the length of the shaft and is united at either end to the fixed structure of the aircraft.

8. An aircraft as claimed in Claims 1,2,3,4,5,6 and 7 wherein the propeller is of contra rotating type which eliminates propeller torque reaction.

9. An aircraft as claimed in Claims 1,2,3,4,5,6,7 and 8 wherein the propeller may be driven by propeller tip propulsion jets supplied with gas or compressed air by a reciprocating engine or gas turbine so as to eliminate propeller torque reaction.

10. An aircraft as claimed in Claims 1,2,3,4,5,6,7,8 and 9 wherein the wheeled landing gear is replaced by a seaplane float or combination of floats to enable the aircraft to operate from water. These floats may be used in combination with retractable wheel landing gear to render the aircraft amphibious.

11. An aircraft as claimed in Claims 1,2,3,4,5,6,7,8,9 and 10 equipped with wing root lockers which may be accessible from the cockpit for the carriage of parcels or of injured persons secured to stretchers or litters.

12. An aircraft as claimed in Claims 1,2,3,4,5,6,7,8,9,10 and 11 wherein the area of fuselage structure in the plane of the propeller is protected with a form of armour plating to protect it from ice flung off the propeller or from catastrophic damage in the event of propeller failure.

13. An aircraft as claimed in Claims 1,2,3,4,5,6,7,8,9,10,11 and 12 wherein the horizontal and vertical tail surfaces are located in such a way as to be partly or wholly in the propeller slipstream which increases their control authority when power is applied to the propeller.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report) -5-

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Relevant Technical fields

(i) UK Cl (Edition L) B7W - WBX WPF WITH W601 OR W611 B7G - GDAA WITH G404, G405 OR G406; G42G

(ii) Int Cl (Edition 5) B64C - 29/00, 39/00
B64D - 27/00, 27/02, 27/04, 27/08, 27/10, 27/14

Search Examiner
B F BAXTER

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI

Date of Search
17 SEPTEMBER 1993

Documents considered relevant following a search in respect of claims 1-13

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2261203 A (SHERRIFF)	1

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

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